



data storage progress better in dna genome or crystals



As of early 2026, both **DNA genome** and **crystal-based storage** (specifically 5D optical glass) have transitioned from theoretical research to the pilot and early commercial phases. While they both target "cold" archival data, DNA is the clear winner for **storage density**, whereas crystals offer unrivaled **longevity**. YouTube +2

1. Storage Density and Capacity

DNA is currently the most compact medium known. www.psu.edu +1

- **DNA Density:** A single gram of DNA can theoretically store up to **215 petabytes** (roughly 215 million gigabytes) of data. Some current estimates suggest a teaspoon of DNA could hold all the world's current digital data.
- **Crystal Density:** High-density crystal storage, such as 5D optical glass, can store approximately **360 terabytes** on a single 5-inch disc. While massive, it is orders of magnitude less dense than DNA. academic.oup.com +5

2. Durability and Longevity

Crystals are significantly more stable and resistant to environmental hazards.

- **Crystal Longevity:** 5D memory crystals are estimated to last up to **13.8 billion years**—even at high temperatures (up to 190°C). They are physically robust against water, radiation, and electromagnetic interference.
- **DNA Longevity:** DNA can last for **thousands to millions of years** if stored in cool, dark, and dry conditions (e.g., encapsulated in silica). However, it is biological and prone to degradation if exposed to heat or liquid environments. academic.oup.com +5

3. Processing Speed and Cost

Both technologies currently face "bottlenecks" in writing and reading data, making them

Ask anything





Comparison Table: DNA vs. Crystals

Feature 	DNA Data Storage	5D Crystal (Glass) Storage
Max Capacity	~215 Petabytes per gram	~360 Terabytes per disc
Durability	Millennia (under strict conditions)	Billions of years (indestructible)
Current Use	Archival "Cold" Data	Archival "Cold" Data
Main Hurdle	Synthesis cost and speed	Adoption and infrastructure
Write Method	Chemical Synthesis	Femtosecond Lasers

Industry Momentum:

The [DNA Data Storage Alliance](#), including members like [Microsoft](#) and [Illumina](#), is standardizing DNA storage protocols for commercial launch in the next 3–5 years. Simultaneously, startups like [SPhotonix](#) are already pitching crystal prototypes to major data center "hyperscalers" for extreme long-term archival.  [www.bbc.com](#) +3

Are you looking for a **long-term archival** solution for a specific type of data, such as historical records or personal backups?

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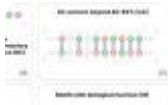


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How close are we to storing data in DNA? - ScienceDirect.com

Feb 15, 2024 — Highlights * DNA is a more efficient and long-lasting data storage method. It offers better compression, higher physical density, ...





www.psu.edu



Wow! DNA could store Petabytes and is only 5 years away ...

Sep 25, 2025 — dna isn't just the code of life. it's code period and multiple companies are working on using DNA to store data indeed they're say...



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average number of farts per person per day by age race gender and sex

While medical estimates traditionally cited **14 to 25 times per day** as normal, recent objective research using sensor-equipped "Smart Underwear" at the **University of Maryland** found a higher average of **32 farts per day** for healthy adults. my.clevelandclinic.org +3

Flatulence frequency varies widely based on individual gut health and diet, with recorded daily ranges from as few as **4** to as many as **59**. [ifl www.iflscience.com](https://www.iflscience.com)

Frequency by Demographics

Specific breakdowns by demographic factors are as follows:

- **Age:** Younger adults (18–24) tend to pass gas **more frequently** than older adults (45+).
 - One large survey found that people aged 45–64 and those over 65 passed flatus significantly less often than the 18–24 age group.
 - The prevalence of related symptoms like bloating also decreases with age: 20.3% for those 18–34 versus 10.4% for those over 65.
- **Sex and Gender:** There is **no significant difference** in the *frequency* of flatulence between biological men and women.
 - While frequency is similar, men generally produce a **larger volume** of gas per

... groups.  pubmed.ncbi.nlm.nih.gov +7

Summary Table: Average Daily Farts

Statistic 	Traditional Estimate	Recent Objective Study (2026)
Average Frequency	14–25 times/day	32 times/day
Normal Range	5–25 times/day	4–59 times/day
Total Gas Volume	400–2,000 ml/day	Variable by diet and body size

For more details on normal ranges and when to seek medical advice, you can refer to resources from the [Cleveland Clinic](#) or [UCLA Health](#).

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Old Farts – Fact or Fiction? Results From a Population-Based ...

Mar 23, 2017 — Table 1 presents flatulence frequency stratified by age and findings from the ordinal logistic regression. Those 45–64 and ≥65 yea...

 www.cghjournal.org



Flatulence (Farting): What it is, Causes, When ... - Cleveland Clinic

Mar 3, 2025 — What is flatulence (farting)? Flatulence (farting) is when you pass gas (flatus) in your digestive system. You may feel embarrasse...

 my.clevelandclinic.org



can holding in farts increase the likelihood of a heart attack

There is no medical evidence to suggest that holding in farts directly causes or increases the likelihood of a heart attack. While it can lead to intense physical discomfort, it is not considered life-threatening. ⓘ www.healthline.com +1

Key Medical Insights

- **Safety of Holding Gas:** Holding in a fart will not cause internal ruptures or lasting damage. If you don't release the gas, it is eventually absorbed into your bloodstream and breathed out through your lungs.
- **Heart Attack Mimicry:** Trapped gas in the upper abdomen can put pressure on the diaphragm, causing sharp chest pain or a "heavy" sensation that mimics heart attack symptoms. This often leads to unnecessary panic, which can further increase your heart rate.
- **Vagus Nerve Stimulation:** Significant bloating from retained gas can stimulate the **vagus nerve**, which connects the gut and the heart. This may trigger temporary heart palpitations or minor fluctuations in blood pressure, but these generally resolve once the gas is passed.
- **Differentiating Pain:** Heart attack pain typically radiates to the jaw, neck, or arms and is often accompanied by nausea or cold sweats. Gas pain is usually localized to the chest or abdomen and often improves after burping or passing gas. ⓘ www.medicalnewstoday.com +9

Risks of Chronic Retention

While not fatal, regularly holding in gas is not recommended as it can lead to: ⓘ

- **Diverticulitis:** Some older research suggests long-term habits of holding in gas might put pressure on the colon wall, potentially contributing to the development of small pouches called diverticula.
- **Gastrocardiac Syndrome (Roemheld Syndrome):** This describes a condition where



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Can Gas Cause Chest Pain?

Jul 3, 2023 — Can Gas Cause Chest Pain? ... The short answer is yes. When it's trapped in your upper abdomen, backed-up intestinal gas can cause...

health.clevelandclinic.org

Is Holding In Farts Healthy for You, Or Are There Side Effects?

May 20, 2020 — Can you die from holding in a fart? There is no evidence that holding in a fart could kill you, though the pain and discomfort doi...

www.healthline.com

What Happens if You Hold in Farts?

Nov 15, 2023 — Is it dangerous to hold gas in? We've all been in situations where we really needed to let loose but could not. Is this harmful? T...

[www.hackensackmeridianhealth.o...](https://www.hackensackmeridianhealth.org)[Show all](#)

does gas ever travel to the heart (during the gas exchange)

No, intestinal gas (like a fart) does not travel to the heart as a gas bubble. If a physical bubble of gas entered your heart or bloodstream, it would cause a life-threatening air

embolism, which is a medical emergency.



and eventually reaching the **lungs**.

4. **Exhalation:** In the lungs, the gas follows its concentration gradient and moves from the blood into the air sacs (alveoli). You then simply **breathe it out**.

While the dissolved gas passes *through* the heart via the blood, it never exists as a pocket of gas inside the heart's chambers.

Are you experiencing **chest pressure** or **palpitations** that feel like they are triggered by bloating?

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does intestinal gas travel through the blood ever?

Yes, intestinal gas regularly travels through your blood, but as a **dissolved substance** rather than as physical bubbles.

If you don't release gas through the rectum, the pressure forces some of it to be absorbed through the lining of the intestines into the bloodstream. This is a normal part of your body's "gas management" system:

- **Absorption:** Gases produced by gut bacteria (like hydrogen, methane, and carbon dioxide) cross the intestinal wall into nearby capillaries.
- **Transport:** These dissolved gases are carried by the blood to the lungs.
- **Exhalation:** Once the blood reaches your lungs, the gases are exchanged into the air sacs and eventually **exhaled through your breath**.

According to researchers at [The University of Queensland](#), this process is the reason



does the same blood get filtered by the heart?

Strictly speaking, **the heart does not filter blood**; that is the job of the **kidneys** and the **liver**.

The heart functions solely as a **pump**. It receives "used" blood from the body and sends it to the lungs to get oxygen, then pumps that fresh blood back out to the rest of the body.

Here is how the true filtering happens to the blood circulating through your heart:

- **The Kidneys:** Filter out liquid waste, toxins, and excess water, which leave the body as urine.
- **The Liver:** Filters out old red blood cells, processes nutrients, and neutralizes toxins or drugs.
- **The Lungs:** Filter out carbon dioxide (and the dissolved intestinal gases we discussed) in exchange for oxygen.

So, while the **same blood** passes through your heart over and over again, it is being cleaned and "refueled" by your other organs during its trip.

Are you asking because you're curious about how **toxins** or **gases** are eventually removed from your system?

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Think of the heart as a **two-sided pump** with very different jobs:

1. The Right Side: The Delivery to the Lungs

The right side of your heart receives "deoxygenated" blood—blood that has already dropped off oxygen to your muscles and picked up waste products like **carbon dioxide** (CO_2) and those **dissolved intestinal gases** we talked about.

- **The Action:** It pumps this "dirty" blood into the **pulmonary artery**, which leads directly to your lungs.
- **The Goal:** To get the blood to the air sacs (alveoli) where the CO_2 and gut gases can be swapped out for fresh oxygen.

2. The Left Side: The Distribution to the Body

Once the lungs have swapped the waste gases for oxygen, the blood returns to the left side of the heart.

- **The Action:** This side is much stronger. It pumps the oxygen-rich blood out through the **aorta** to the rest of your body.
- **The Goal:** To ensure every organ and tissue gets the oxygen it needs to survive.

Why this matters for "Gas Exchange"

Without the heart's constant pumping, the gases would just sit still.

- **Speed:** Under normal conditions, it takes about **one minute** for a drop of blood to travel from the heart, to the lungs, back to the heart, and out to the body.
- **Pressure:** The heart provides the pressure necessary to push blood through the tiny capillaries in the lungs where the actual "swap" happens.

In short: The **lungs** are the marketplace where the gases are traded, but the **heart** is the truck driver that keeps the shipments moving in and out.

Are you interested in how **exercise** or **heart rate** changes how fast this gas exchange



so gas isn't getting filtered by the heart, but it does travel through and may get "stuck"

No, gas **cannot** get "**stuck**" in the heart under normal biological conditions.

It is a common misconception, but here is why that doesn't happen with the intestinal gas we've been discussing:

1. It's Dissolved, Not a Bubble

The intestinal gas that enters your bloodstream behaves like **sugar stirred into tea**. It is "dissolved" into the liquid part of your blood (the plasma). Because it isn't a solid object or a physical air bubble, it flows wherever the liquid flows. It can't get stuck any more than the water in the blood can get stuck.

2. The Heart is a High-Pressure Flush

The heart is essentially a powerful, muscular "squeeze bulb." Even if a tiny micro-bubble were to form, the turbulence and high pressure of the heart's contractions would likely break it up or flush it out instantly toward the lungs.

3. The Only Way Gas Gets "Stuck" (Medical Emergencies)

The only time gas gets "stuck" in the heart is a rare and dangerous condition called an **Air Embolism**. This doesn't happen from holding in farts; it happens from:

- Serious trauma (like a deep puncture wound to the chest).
- Major surgical complications.
- Scuba diving accidents (the "bends").

In those cases, a large volume of **atmospheric air** enters the veins all at once, creating a "vapor lock" that stops the pump. Again, your body is physically incapable of absorbing

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what about elevating ones body and changing positions, does changing body positions (like a vial with water and an air ...



Changing your body position definitely helps move gas, but only while it's still in your **intestines**, not while it's in your blood.

When gas is inside your digestive tract, it acts exactly like that bubble in a vial of water. Because gas is lighter than the solid and liquid waste in your gut, it always tries to "rise" to the highest point.

How Movement Helps Clear Gas

By twisting, stretching, or inverting your body, you are manually shifting those gas pockets toward the "exit" (the rectum). This prevents gas from getting trapped in the high corners of your colon, which is often what causes that sharp chest or rib pain.

Effective positions to move gas outward:

- **The "Knees-to-Chest" Pose:** Lying on your back and pulling your knees to your chest compresses the abdomen and helps push gas toward the rectum.
- **The "Child's Pose":** This yoga move uses gravity to shift gas away from the upper abdomen (near the heart) and down toward the exit.
- **Left-Side Lying:** The way the human colon is shaped, lying on your **left side** often makes it easier for gas to travel "downhill" toward the rectum.



Are you trying to **relieve specific gas pain** right now, or are you just curious about the physics of it?

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what different types of gas travel through the heart

The heart pumps blood containing several different dissolved gases. Because these gases are dissolved in the plasma or bound to hemoglobin, they don't form bubbles; they are just part of the chemical makeup of your blood.

The primary gases traveling through your heart are:

1. Oxygen (O_2)

- **Path:** Enters the left side of the heart from the lungs and is pumped out to the rest of the body.
- **Purpose:** The "fuel" your cells need to create energy.

2. Carbon Dioxide (CO_2)

- **Path:** Enters the right side of the heart from the body's tissues and is pumped to the lungs.
- **Purpose:** A waste product of metabolism that you need to breathe out.

3. Nitrogen (N_2)

- **Path:** Circulates throughout the entire heart and body at all times



- **Hydrogen (H_2):** Produced by bacteria breaking down carbohydrates.
- **Methane (CH_4):** Produced by specific microbes (in about 1/3 of the population).
- **Hydrogen Sulfide (H_2S):** The "rotten egg" smelling gas; in very tiny, dissolved amounts, it actually acts as a signaling molecule to help relax blood vessels.

5. Carbon Monoxide (CO)

- **Note:** This is only present in significant amounts if you are a smoker or have been exposed to exhaust/smoke. It binds very tightly to the hemoglobin in your blood as it passes through the heart.

Would you like to know more about how **hydrogen sulfide** specifically interacts with your **blood vessels**?

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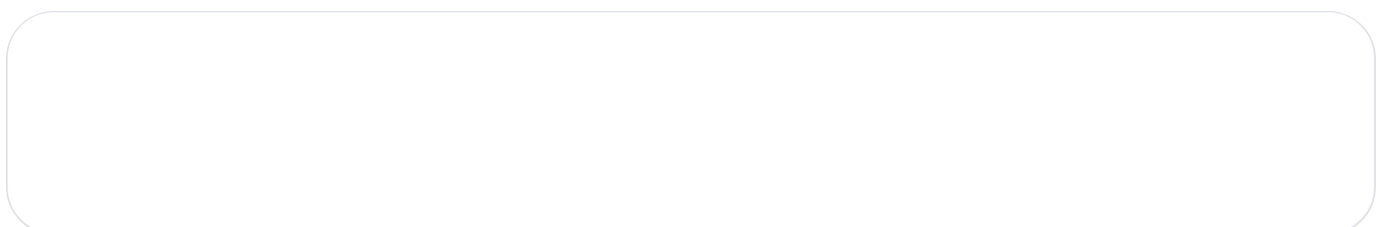
can it essentially contain every gas in the environment? that your body absorbs?

In short: **Yes**. If a gas exists in your environment and you breathe it in or absorb it through your skin or gut, it will enter your bloodstream and pass through your heart.

Your blood is an excellent solvent. While it mostly carries the "big three" (Oxygen, Carbon Dioxide, and Nitrogen), it will pick up virtually **any gas** it comes into contact with.

Here is how different environmental gases get into that "heart loop":

1. Gases You Breathe (The Lungs)





- **Anesthetics:** Nitrous oxide ("laughing gas") or xenon used in surgeries.

2. Gases You Ingest (The Gut)

As we discussed, gases produced by bacteria (Hydrogen, Methane) or swallowed air (mostly Nitrogen) move from the intestines into the blood.

3. Gases You Absorb (The Skin)

To a much lesser extent, your skin can absorb gases. For example, if you are in a carbon dioxide-rich bath or a sulfur spring, trace amounts can enter the capillaries in your skin and head toward the heart.

Why doesn't this kill us?

The "dose makes the poison." Most environmental gases (like Argon or Helium) are **inert**, meaning they just "float" in the blood without reacting with your tissues. They take a ride through the heart, reach the lungs, and you eventually breathe them back out once you're in a clean environment.

The exception: Gases like **Carbon Monoxide** or **Hydrogen Cyanide** are dangerous because they don't just "float"—they "stick" to your blood cells and prevent them from carrying oxygen.

Are you curious about a **specific gas**—like something from a workplace or a hobby—and how it might affect your system?

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1. Can a Cow "Explode"?

In extreme medical cases, the answer is "sort of," but not through fire. [🔗](#)

- **Physical Rupture:** When a cow eats certain foods like wet clover or alfalfa, a stable foam forms in the rumen (first stomach) that traps fermentation gases like **methane** and **carbon dioxide**.
- **Lethal Pressure:** This foam prevents the cow from belching. The rumen can swell so much that it balloons to gargantuan sizes, eventually crushing the cow's lungs and heart or, in rare cases, causing the rumen to burst.
- **Emergency Intervention:** To prevent this "explosion," farmers or veterinarians may use a **trocar** (a sharp needle) to puncture the cow's side, allowing the pressurized gas to escape with a loud hiss. [🌐 www.sciencehistory.org](https://www.sciencehistory.org) +4

2. External Methane Explosions

While the animal doesn't catch fire internally, the gas it releases can be dangerous if it builds up in unventilated areas. [🔗](#)

- **The Rasdorf Incident:** In 2014, a herd of 90 dairy cows in Rasdorf, Germany, released so much methane through belching and flatulence that a static electric charge ignited the gas. The resulting explosion damaged the barn roof and left one cow with minor burns.
- **Flammability Demonstration:** Because the gas released from a bloated cow is roughly 60% methane, it is highly flammable. Some educational videos show farmers lighting the gas as it escapes from a trocar to demonstrate its potency, though this is **not** a standard medical procedure and can be extremely dangerous. [📷 Instagram](#) +3

Summary of Gas Types in Cows

The "fuel" for these potential explosions consists of several gases produced during digestion: [🔗](#)

- **Methane (CH_4):** The primary flammable component, produced by microbes



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The flame is caused by gas released from a cow's bloated ...

Jun 1, 2025 — Cows can suffer from a dangerous condition called Bloat (ruminal tympany), where gas builds up in the stomach during digestion, es...



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Tummy Trouble | Science History Institute

Mar 30, 2018 — It sounded alarming—exploding cows! But the state had sound reasons for regulating cattle digestion. And while cows can indeed exp...

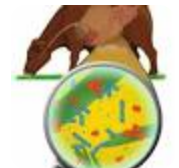


www.sciencehistory.org



CRITICAL THINKING ACTIVITY: A LIVESTOCK DILEMMA

Methane is the second most significant greenhouse gas and cows are one of the greatest methane emitters. Their grassy diet and mul...



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whats the best way to reduce the likelihood of this happening in cows?

Preventing deadly gas buildup in cows, known as **rumen bloat**, requires a combination of strict grazing management and specialized feed additives. Because bloat can cause



- **Ionophores:** Additives like **monensin** (Rumensin) or **lasalocid** (Bovatec) change the microbial activity in the rumen, reducing the total volume of gas and foam produced.
- **Anti-foaming Oils:** For short-term risk, adding vegetable or mineral oils to water or feed can reduce surface tension in the rumen, though this requires more frequent dosing than medicated blocks. [N extensionpubs.unl.edu +4](#)

2. Strategic Grazing Management

Controlling *when* and *what* the cows eat is the first line of defense against "pasture bloat." [🔗](#)

- **Pre-Fill with Dry Hay:** Never turn hungry cows out onto lush, green pastures. Fill them with dry, long-stem hay first so they don't overeat the high-risk forage.
- **Avoid Wet Pastures:** Do not release cattle to graze when the grass is wet from dew or rain. Moisture increases the rate of digestion and encourages over-eating, both of which trigger bloat.
- **Wait for Maturity:** Older, more mature plants are less likely to cause bloat. For example, wait until alfalfa is in at least 25% bloom before allowing heavy grazing.
- **Maintain Pasture Mixes:** Aim for a pasture that is at least **50% grass** and no more than 50% legumes like clover or alfalfa. [N extensionpubs.unl.edu +3](#)

3. Feedlot Management

For cows on grain-heavy diets, the goal is to keep the digestive system moving and prevent "free-gas" buildup.

- **Fiber Content:** Ensure the ration contains at least **10–15% coarse roughage** (like chopped straw or grass hay) to stimulate saliva and rumen movement.
- **Consistent Intake:** Avoid "binge eating" by providing consistent access to feed and avoiding finely ground grains, which ferment too quickly. [N extensionpubs.unl.edu +1](#)

If an animal does bloat, having emergency supplies like a VetOne Bloat Treatment Drench



Movement and Walking

Light movement is often used alongside positioning to stimulate the digestive system.

- **Stimulating the Rumen:** Walking a cow can help stimulate rumen contractions and aid in the release of gas.
- **Coalescing Bubbles:** For mildly bloated cattle, walking can help "shake the foam down" and merge smaller bubbles into a larger one that is easier to expel.
- **Caution with Severe Cases:** While movement is helpful for mild or early-stage bloat, avoid rounding up cattle too quickly if they are already severely distressed, as excessive jostling can sometimes worsen the condition.  www.nrcs.usda.gov +2

Risks of Poor Positioning

Certain body positions are dangerous for a bloated animal and can lead to death: 

- **Lateral or Dorsal Recumbency:** If a ruminant becomes "cast" (stuck) on its back or side, it may die of bloat because it cannot belch in these positions.
- **Restrictive Environments:** Crowded transportation or irrigation ditches can trap animals in these lethal positions.  www.merckvetmanual.com

For more detailed guidance on identifying and managing these emergencies, you can refer to the [MSD Veterinary Manual](#) or the [Oklahoma State Extension](#).

Would you like to see a list of **emergency supplies** to keep on hand for a bloated cow?

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 www.angus.org



Bloat in Ruminants - Digestive System

Unusual postures, particularly lateral recumbency, are commonly associated with secondary tympany. Ruminants may die of bloat if t...



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